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Operational Review of the Commonwealth's Water Management

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Introduction:

Governor McDonnell issued Executive Order No. 19 (2010) "Conservation and Efficiency in the Operation of State Government," highlighting the importance of state government setting an example in its use of all resources. The Governor further charged state agencies and institutions, offices and organizations, to take the lead in adopting practices and policies that maximize efficiency and conservation, and minimizing waste and the impact of operations on the environment.

The Water Usage Group (WSG) was tasked with researching current water service costs in state facilities and institutions. In areas where improvements can be made, recommended reduction practices for agency water usage will be made. It is largely assumed throughout this review that reductions in overall water use will equate to reductions in water service costs.

Total Spent for Water Consumption in the Commonwealth

The initial step taken by the WSG was to ascertain actual costs for water usage at state facilities. The object code in the Commonwealth Accounting System includes agency costs for water and sewer but without knowing the age of the facility, age of the equipment, number of water gallons used, and steps taken to reduce water use to date, an assessment of opportunities for savings proved to be challenging. In addition, state facilities may pay differing amounts per unit of water based on whether utilities are included in the lease or not and what the water rates of the locality are where the facility is located. It is important to note that this accounting data is not currently adequate to make meaningful comparisons among agencies on opportunities to reduce costs spent on water and sewer service. This report will recommend that there are opportunities to make improvements to the accounting system to provide greater visibility into the actual expenditures for water and wastewater as well as steps that can be implemented to better understand the opportunities for reducing water use and associated costs of service at any agency. Those agencies that pay their utilities separate from their lease payments or are state owned appear to have the greatest potential for reducing overall use and costs.

Expenditures provided by the Department of Accounts for object code 1544 -Water and Sewer Service Charges, included expenditures for utility services both statewide and separated by agency. From FY2008 through FY2010 utility costs increased nearly 64% from nearly $26 million to nearly $41 million dollars. During that same time period utility costs for state agencies dropped by slightly more than $1 million while higher education

costs rose by $1 million. FY 2008 was not used as it is considered incomplete for higher education. The highest utility costs among state agencies over the period are the Department of Corrections and its facilities, State or University Hospitals, and the Department of Transportation. The large higher education campuses are the source of the highest single utility costs. These four categories of state facilities represent the single greatest opportunity to improve understanding of agency water use and to reduce overall water utility costs. A summary of the data[1] is shown below:

	AGENCY	HIGHER ED	COMBINED
FY2008	16,653,888.28	9,213,278.72	25,867,167.00
FY2009	15,633,914.26	23,899,286.59	39,533,200.85
FY2010	15,532,797.83	25,084,780.19	40,617,578.02
3 YR TOTAL	47,820,600.37	58,197,345.50	106,017,945.87

In reviewing the summary of water and sewer expenditures by agency, there is wide variation in costs from year to year in some facilities and among facilities of similar size and character. This is likely due to specific issues unique to that facility and its location. Therefore, no significant trends or conclusions can be drawn from this information. It appears that individual case studies may be the most valuable approach to determining potential savings but that is not possible for the scope of this report. The following is an analysis of various agency and higher education water usage cost per student/employee/bed.[2] The point illustrated by the table below is that water and sewer costs vary greatly by number of employees/students/beds across the state and from facility to facility. It appears that water costs are based more on agency activities than the number of employees. Opportunities for cost reductions could be analyzed if cost per gallon of water used were derived. This is not possible with the time and data available.

Agency/Institution	Total Water/Sewer Charges (Annual)	Number of Employees/Students/Beds	Annual Cost per Employee/Student/Bed
State Corporation Commission	$84,858.33	658	$128.96
Dept. of Conservation and Recreation	$302,201.35	543	$556.54
Dept. of Game & Inland Fisheries	$20,503.71	496	$41.38
Red Onion State Prison	$521,308.13	1,005	$518.71
Keen Mountain Correctional Center	$303,263.15	1,024	$296.16
Department of Juvenile Justice	$111,911.33	2392	$46.79
Department of Forensic Science	$194,852.80	316	$616.62
Higher Education		(includes part-time students)	
Wytheville Community College	$6,782.48	5,441	$1.25

Blue Ridge Community College	$23,033.61	7,075	$3.26
Tidewater Community College	$222,891.94	47,170	$4.73
Germanna Community College	$40,163.07	10,060	$3.99

Best Practices Available for Reducing Costs

The WSG reviewed a number of best practices and all may have some merit to an agency seeking to reduce water and sewer costs. While some best practices are recommended, it must be noted that many of these are site specific and may not always be relevant in a general context. Consideration must be given to the age of a facility and fixtures, water rate structure, occupancy, and type of usage, among other factors. The following recommendations are provided to put the Commonwealth in a position to improve data collection generally and to provide an on-going opportunity for keeping the focus on long term water efficiency and cost reduction:

- Consider improvements to the state accounting system to provide greater visibility into the actual expenditures for water and wastewater. Not only will this enable a focus on the most important issues, it will also allow the state to measure the results from the proposed initiatives. Performance metrics can then have a financial component further driving efficiencies and the development of best practices.
- Designate a single state employee or an outside firm contracted by the state to be responsible to collect data on water use, review water use and cost, and to provide technical assistance to agencies on assessing opportunities for improving efficiency and reducing costs. This position should be responsible for analyzing consumption and cost trends relative to water usage in state facilities and to help agencies perform water audits and develop best practices for their facilities.
- Consider a state-wide requirement for an Agency Environmental Management System (EMS) and train employees in water use awareness. Establish a system to encourage all state employees to notify the proper parties about leaks, drippy faucets, broken sprinklers, or other occurrences of water waste.
- Design and construct new state buildings to LEED standards.
- Conduct a state wide study to review: 1) whether there is a different cost impact associated with full service leases versus agencies paying the water utility bill directly; and 2) the cost effectiveness of owning and operating water and wastewater facilities independently versus organizing them more efficiently or even privatizing them. The state should look at how they are operated, and see if efficiencies can be gained by consolidating management of these facilities, even across multiple agencies within a common geographic area. A number of these small facilities could be grouped together geographically and managed by a single centrally located operating unit on a "circuit rider" type arrangement where skills, operating licenses, repair materials, water quality labs, and resources are shared and not developed and maintained independently.

After considering the range of best practices, the following recommendations are made to individual agencies and facilities to improve water efficiency and reduce costs (targeted to agencies that lease facilities or pay others for their water service):

- Audit your water bills
    - Use Automatic Meter Reading (AMR) software that is available to screen for changes in use which may reflect leaking infrastructure (identifying an opportunity to reduce water that is paid for by not used.)
    - Read your own meter and compare to water bill as errors are not uncommon.
    - Flag estimated bills and question them as they typically over-estimate use and therefore cost. If a sewer bill is based on the average water usage, an estimated bill can impact your sewer billing all year long, although many activities such as irrigation and vehicle washing, typically occur only or primarily in the summer months.
    - Meter fire lines separately – don't mix up the bills! Fire line rate should be significantly lower.
    - Compare water bill rates to those in the annual Draper Aden study (source of costs across the state by utility system) to see if lower rate could be negotiated. Also compare the rate being charged the state vs. the rate being charged other customers in the same system.
    - Reduce water use = reduced sewer bill. It is important to understand the relationship between water and sewer billing. If the sewer bill is based on the average winter usage (since lawn watering and car washing in summer do not add to the sewer bill) then an estimated bill in winter can impact your sewer billing all year long.
    - Audit your water use – e.g. AWWA software

For Commonwealth-owned facilities and those that supply their own water, audit current usage to identify potential applications for best practices:

- Audit water use to assess current uses and costs: 1) Identify water management opportunities; 2) Prepare a plan and implementation schedule; 3) Track results and publicize success.
- Develop replacement schedules for water inefficient systems:
    - Replace chillers and refrigeration units that use once through cooling systems.
    - Replace fixtures and faucets with WaterSense labeled products. Offices built before 1997 should change out toilets and urinals. After 1997, the standard changed to: 1) Use no more than 1.6 gallons of water per flush toilets; 2) Use no more than 1.0 gallon of water per flush urinals. There is high efficiency urinal models designed to use .05 gpf or less.
    - Use no-water urinals when appropriate – Consideration would need to be given for maintenance and or replacement parts over the lifetime of the product. Cleaning crew will need to be trained on cleaning and replacing the filters.

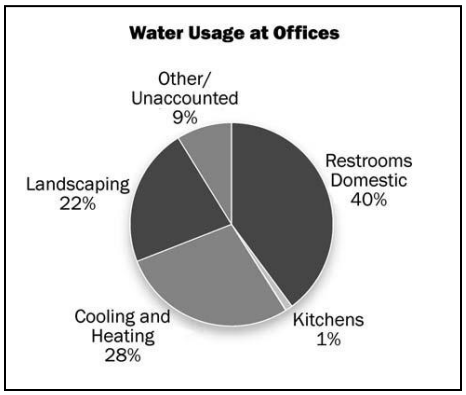
    - Install automatic sensors on faucets.
- Consider retrofitting grounds and landscapes over time:
    - Use native plants that are tolerant of local soil and rainfall conditions for landscaping.
    - Replace cool season grasses with Virginia Tech hybrid warm season grasses which require 40% less water.
    - Convert irrigation systems to moisture sensing WaterSense irrigation systems.
    - Stop irrigation when locality goes to water conservation.
    - Use rainwater harvesting or reuse to supplement or meet irrigation needs.
- Consider bulk purchasing opportunities:
    - For metropolitan areas with a large number of state-owned buildings, develop regional consolidated contracts to reduce costs, e.g. utility service, low flow fixtures in bulk.
    - For self supplied agencies consider bulk chemical purchases to reduce costs (state contract?)
- Hospitals should determine if there could be a cost savings realized if laundry services were outsourced.
- Colleges/Universities with food courts should ensure that the restaurants are metered and billed separately so the restaurants are paying for their water usage.
- Large facilities should consider multi-metering throughout their water system for better leak detection and repair and for better high usage analysis.

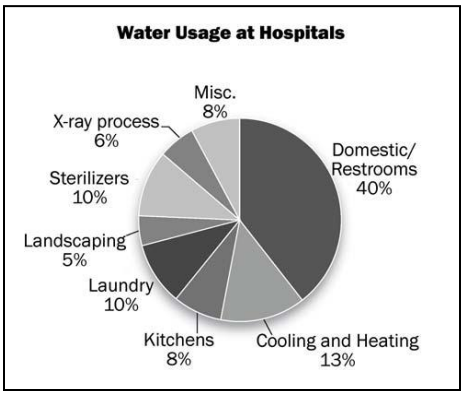
In addition to the best practices listed above, the WSG feels that several best practice opportunities may prove useful with further development. These future best practice opportunities:

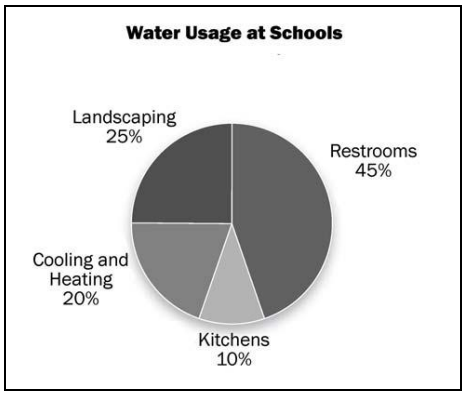
- Opportunities for water reuse?
- Water efficiency tax holiday opportunities for low impact purchases at state leased facilities
- Reduce water use to extend life cycle costs of septic drain fields
- For metropolitan areas with a large number of state-owned buildings, develop regional consolidated contracts to reduce costs.

Recommended Level of Spending for Agency Water Management Expenses

To determine an agency's recommended level of spending, The WSG recommends that any individual agency conduct a water audit to determine their water usage, the associated costs, and what opportunities are available to reduce these costs. A typical assessment begins with determining the agency water budget. Some typical water budgets for facility type are available to provide guidance on water use. Information of this kind provides a basis for assessing what portions of an agency's water use is most likely to be reduced, resulting in reductions in utility costs. The following examples[3] for office, hospital, and school facilities are provided illustrate a water budget. Each facility should determine its own unique water balance to best target opportunities for cost savings.





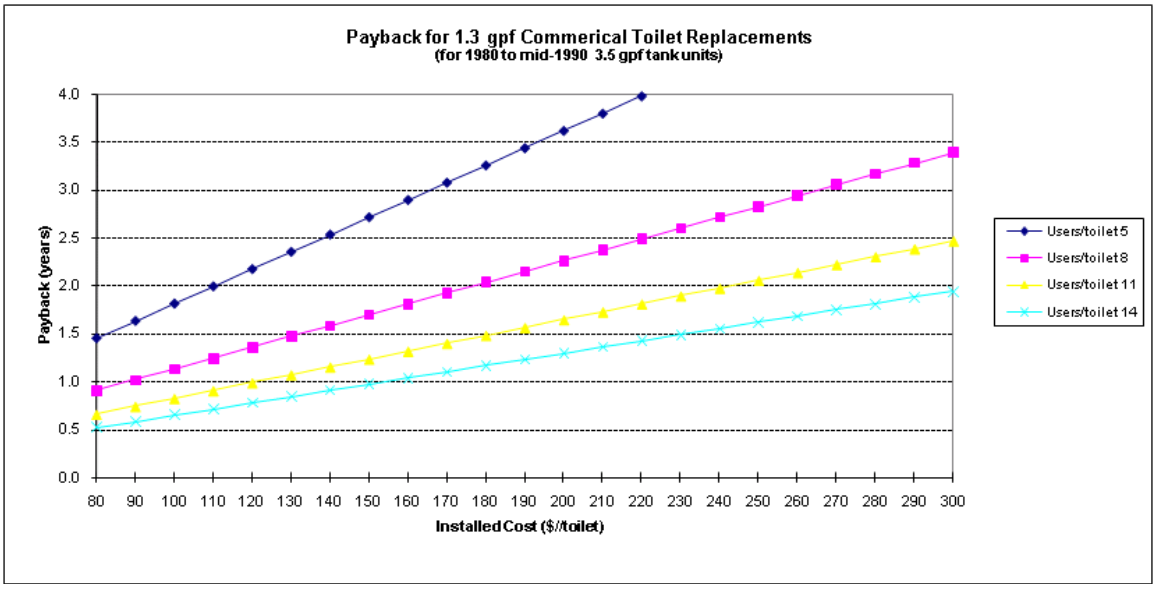


Given the nature of the information available to us, no specific recommendation on spending for agency water expenses could be determined. Water use expenses will vary widely among the various state agencies and institutions of higher education due to a number of factors including age of the facility and fixtures, number of employees/students/inmates, amount of water use per employee/student/inmate, type of water use, amount of irrigation or outdoor watering (fleet washing), and utility rates, among others. A simple water audit is recommended for all agencies to look at the items outlined in the table[4] below (or others specific to the facility).

Source of water use	Gallons per Year (est.)	Percent of Total	Water Cost ($/yr)	Sewer Cost ($/yr)	Energy/Other Costs ($yr)
Domestic					
Heating/cooling					
Rinsing/cleaning					
Landscaping					
other					
other					
other					
Unaccounted for					
Total					

Recommended Level of Agency Cost Savings

Replacement of current fixtures with WaterSense or EnergyStar labeled fixtures or appliances are designed to reduce water use by as much as 20% compared to the industry standard. Implementing this best practice alone has the potential to reduce costs by an equivalent percentage as well as saving sewer charges based on the facility's level of water use. A concern often expressed about such retrofits is that it takes too long to reach breakeven for the return on the capital investment. The table[5] below demonstrates the typical payback periods and initial costs for installation of four common styles of 1.3 gallons per flush toilets (gpf) as replacements for 3.5 gpf toilets manufactured during the 1980 to mid-1990 period.



The retrofitting of toilets alone in agencies that do not have water efficient fixtures can save on water use, reducing water and sewer costs within a reasonable period of time to payback the initial investment. A case study[6] from the Department of Corrections appears below:

Case Study

The VA DOC has developed a Water Conservation and Management Plan to reduce the amount of water used on a daily basis, and also addresses water use during drought and emergency events. The following are a few examples of water conservation efforts in Inmate Housing Units and Cells.

- Showers shall have restrictor (water saving aerators) devices;
- All shower mixing valves should have the capabilities of being controlled by either time limitations, motion detection, or any other control that limits the time a shower operates and prevents prolonged use;
- Water saver toilet designs can only be utilized where security is not jeopardized. Toilet flushometers should be specifically designed to lessen the amount of gallons per flush while not affecting the proper amount of water necessary for full flush
- Water-cooled ice makers are high in use of water and shall not be installed.

From the Department of Corrections Case Study we can see that efforts can reduce water using other water efficient fixtures other than toilets. Typical installation costs and return on investment periods for the range of water efficient fixtures is contained in the table[7] below.

Fixture	Existing Style/Flow Rates	Water Efficiency Options	Installed Cost ($)	Typical Payback (years)
Toilets Flushometer Type	Flushometer - 1.6 gpf	Install dual flush valve – 1.28 gpf.	$50-$80	3-4
	Flushometer - 3.5 gpf	Install new HET or 1.6 gpf	$200-$300	2.0-4.5
Urinals	Flushometer - 1.0 gpf	Install new HEU - 0.5 gpm	$200-$450	Less than 7
	Flushometer - 1.6 gpf	Install new 1.0 gpm valve (nonpooling)	$20-$40	0.5-1.3
	Flushometer - 3.0 gpf	Install new 1.0 gpm valve	$200-$450	1.8-5.6
Showerheads	2.5 gpm	Install 1.5 gpm head	Less than $35	0.6-1.3
	3-5 gpm	Install 2.5 gpm head	$25-$30	0.4-2
	5-8 gpm	Install 2.5 gpm head	$25-$30	Less than 2
Kitchen Faucets	3-7 gpm	Install 2.2 gpm aerator	$5-$10	0.2-2
Lavatory Faucets	2.2 gpm	Install 0.5 gpm aerator	$5-$10	0.05-0.7
	3-7 gpm	Install 1.0 gpm aerator	$5-$10	Less than 0.3

Sources of Best Practices

1. 2007-08 Water Study: Previous study conducted in Virginia.
2. EPA WaterSense at http://www.epa.gov/watersense/; http://www.epa.gov/watersense/partners/commercial_institutional.html
3. VEEP
4. DEQ EMS
5. Alliance for Water Efficiency at http://allianceforwaterefficiency.org/
6. EPA Green Infrastructure policies www.epa.gov/npdes/greeninfrastructure
7. The International Storm Water Best Management Practices (BMP) database http://www.wbdg.org/design/conserve_water.php
8. Federal Energy Management Program developed Federal Water Efficiency Best Management Practices (BMPs) in response to Executive Order (E.O.) 13123 requirements, which required Federal agencies to reduce water use through cost-

effective water efficiency improvements.
http://www1.eere.energy.gov/femp/program/waterefficiency_bmp.html

[1] 2010. Material provided by the Department of Accounts for cost code 1544.
[2] 2010. The information was obtained from web-sites, individuals working at the various facilities, and FY 10 Budget-Chapter 7
[3] North Carolina Department of Environment and Natural Resources, 2009. Water Efficiency Manual for Commercial, Industrial and Institutional Facilities. There are also other sources of similar analysis from: New Mexico Office of the State Engineer, Water Conservation Guide for Commercial, Institutional, and Industrial Water Users, July 1999 (original source: City of San Jose Environmental Services Department); Dziegielewski, et. al., Commercial and Institutional End Uses of Water, 2000; East Bay Municipal Utility District, WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses, 2008; American Water Works Association, Helping Businesses Manage Water Use, A Guide for Water Utilities.
[4] Modified from North Carolina Department of Environment and Natural Resources, 2009. Water Efficiency Manual for Commercial, Industrial and Institutional Facilities.
[5] North Carolina Department of Environment and Natural Resources, 2009. Water Efficiency Manual for Commercial, Industrial and Institutional Facilities.
[6] The Department of Environmental Quality, 2010, Pollution Prevention Program: Environmental Excellence.
[7] North Carolina Department of Environment and Natural Resources, 2009. Water Efficiency Manual for Commercial, Industrial and Institutional Facilities. Return on investment based on North Carolina state-wide average water and sewer rate of $6.76 per 1,000 gallons (2006) compared with the Virginia statewide water rate average of $5.00 per 1,000 gallons (2010). With combined Virginia water and sewer rates returns are estimated to be similar or even shorter than those presented in the table.